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to Elements II for every tenth degree of mean anomaly to the date of the next periastron passage.

EPHEMERIS.

DATE.	M.	θ	ρ
1903.077	260°	18°.6	0".48
1903.845	270	23 .6	0 .43
1904.613	280	30 .1	0 .37
1905.382	290	38 .9	0 .31
1906.150	300	51 .8	0 .26
1906.918	310	71 .2	0 .21
1907.687	320	97 .8	0 .19
1908.455	330	125 .7	0 .20
1909.223	340	147 .3	0 .24
1909.992	350	162 .8	0 .28
1910.760	360	175 .0	0 .30

September 7, 1902.

PLANETARY PHENOMENA FOR NOVEMBER AND DECEMBER, 1902.

BY MALCOLM MCNEILL.

NOVEMBER.

Mercury is a morning star throughout the month, coming to greatest west elongation on the morning of November 4th. It will then rise about an hour and a half before sunrise, and until about November 20th it will be above the horizon at least an hour before the Sun. The present west elongation is only 19° (less by 8° than the east elongation of September), due to the fact that the planet passed its perihelion on October 24th, only a week before the time of greatest elongation.

Venus has been morning star since February 14th, but now comes to superior conjunction, and becomes an evening star on November 28th. It is almost too near the Sun to be seen at any time during the month.

Mars rises not long after midnight, coming to the horizon about one minute earlier each night. It moves 15° eastward and southward through *Leo* into *Virgo*. No very bright stars are near its path, but toward the close of the month it is somewhat to the west of β *Virginis*. It is beginning to approach

the Earth quite rapidly, and consequently is beginning to be much brighter; but it is still faint as compared with its appearance when it is near opposition.

Jupiter is still in good position for early evening observation, but it sets shortly after nine o'clock at the close of the month. It is in quadrature with the Sun on November 1st, and during the month moves about 4° eastward and 1° northward in the constellation *Capricorn*.

Saturn is getting rather close to the Sun for good observation, although it does not set until about 8 P. M. at the close of the month. It is also in *Capricorn*, about 17° west of *Jupiter*, and moves more than 2° eastward during the month.

Uranus is still closer to the Sun than *Saturn* is, and in the same quarter of the heavens. It is entirely too low for such a faint object to be seen in the evening twilight. It moves about 2° eastward in the constellation *Ophiuchus*.

Neptune rises shortly after sunset. It is in the western part of *Gemini*.

DECEMBER.

The Sun reaches the winter solstice and winter begins December 22d, 10 A. M. Pacific time.

Mercury begins the month as morning star, too near the Sun to be seen, passes superior conjunction and becomes an evening star on December 12th, but hardly reaches a sufficient distance from the Sun to be visible to the naked eye until after the close of the month. It is in conjunction with *Venus* about midnight on December 21st, but both planets are then too near the Sun to be visible to the naked eye.

Venus becomes an evening star on November 28th, but it is rather slow about moving away from the Sun, reaching a distance of only about 8° at the end of the month. As it is also on the far side of its orbit beyond the Sun, it will be much less bright than usual, and it will hardly be possible to see it unless under exceptionally good conditions of the atmosphere.

Mars will rise before midnight at the close of the month. It moves eastward about 13° and southward about 5° in the constellation *Virgo*, and is beginning to slacken up its speed among the stars. It will begin to retrograde early in 1903. Its distance in millions of miles from the Earth diminishes from 145 to 118, and consequently it gains nearly one half in

brightness during the month. So it has become a fairly conspicuous object.

Jupiter sets before 8 P. M. at the close of the month, and is therefore getting rather low for telescopic observation, but it is still fairly seen by the naked eye, and is in fact the most conspicuous object in that part of the evening sky. It moves 6° eastward during the month, but still remains in *Capricorn*.

Saturn is still lower than *Jupiter*, and at the close of the month sets less than an hour and a half after sunset. With its low altitude in the evening twilight, it is no longer a conspicuous object, but it is still far enough away from the Sun to be identified without aid from a telescope. It is also in *Capricorn*, and moves eastward more than 3° during the month.

Uranus comes to conjunction with the Sun on December 14th, changing from an evening to a morning star, but is too faint to be made out even with a telescope at such a short distance from the Sun as it has at any time during the month.

Neptune is in opposition with the Sun on December 24th, and is above the horizon practically the entire night.

NOVEMBER-DECEMBER, 1902.

PHASES OF THE MOON, P. S. T.

First Quarter, . . .	Nov. 8,	4 ^h 30 ^m	A. M.
Full Moon, . . .	Nov. 15,	9	6
Last Quarter, . . .	Nov. 21,	11 47	P. M.
New Moon, . . .	Nov. 29,	6	4
First Quarter, . . .	Dec. 7,	10 26	
Full Moon, . . .	Dec. 14,	7 47	
Last Quarter, . . .	Dec. 21,	Noon.	
New Moon, . . .	Dec. 29,	1 25	P. M.

THE SUN.

1902.	R. A.	Declination.	Rises.	Transits.	Sets.
Nov. 1,	14 ^h 23 ^m	— 14 ^o 13'	6 ^h 33 ^m A. M.	11 ^h 44 ^m A. M.	4 ^h 55 ^m P. M.
11, 15	3	— 17 15	6 44	11 44	4 44
21, 15	44	— 19 47	6 56	11 46	4 36
Dec. 1, 16	26	— 21 43	7 7	11 49	4 31
11, 17	10	— 22 57	7 16	11 53	4 30
21, 17	54	— 23 27	7 24	11 58	4 32
31, 18	39	— 23 9	7 27	12 3 P. M.	4 39

MERCURY.

Nov.	1,	13	17	—	5	57	4	57	A.M.	10	37	A.M.	4	17	P.M.
	11,	13	59	—	10	0	5	14		10	40		4	6	
	21,	14	57	—	15	44	5	54		10	59		4	4	
Dec.	1,	16	1	—	20	41	6	37		11	23		4	9	
	11,	17	7	—	24	1	7	18		11	50		4	22	
	21,	18	17	—	25	17	7	53		12	20	P.M.	4	47	
	31,	19	27	—	24	07	8	20		12	52		5	24	

VENUS.

Nov.	1,	13	58	—	10	49	5	56	A.M.	11	19	A.M.	4	42	P.M.
	11,	14	47	—	15	9	6	20		11	28		4	36	
	21,	15	37	—	18	50	6	46		11	39		4	32	
Dec.	1,	16	29	—	21	39	7	8		11	51		4	34	
	11,	17	23	—	23	25	7	31		12	6	P.M.	4	41	
	21,	18	18	—	24	1	7	49		12	21		4	53	
	31,	19	13	—	23	22	8	2		12	37		5	12	

MARS.

Nov.	1,	10	29	+	11	12	1	11	A.M.	7	50	A.M.	2	29	P.M.
	11,	10	51	+	9	13	1	0		7	32		2	4	
	21,	11	11	+	7	15	12	48		7	13		1	38	
Dec.	1,	11	30	+	5	20	12	35		6	53		1	11	
	11,	11	49	+	3	31	12	20		6	32		12	44	
	21,	12	6	+	1	48	12	4		6	10		12	16	
	31,	12	22	+	0	16	11	45	P.M.	5	46		11	47	A.M.

JUPITER.

Nov.	1,	20	45	—	18	56	1	12	P.M.	6	05	P.M.	10	58	P.M.
Dec.	1,	21	1	—	17	51	11	26	A.M.	4	23		9	20	
Jan.	1,	21	25	—	16	5	9	40		2	44		7	48	

SATURN.

Nov.	1,	19	36	—	21	49	12	14	P.M.	4	56	P.M.	9	38	P.M.
Dec.	1,	19	46	—	21	17	10	24	A.M.	3	8		7	52	
Jan.	1,	20	0	—	20	52	8	35		1	20		6	5	

URANUS.

Nov.	1,	17	12	—	23	5	9	55	A.M.	2	32	P.M.	7	9	P.M.
Dec.	1,	17	19	—	23	13	8	6		12	42		5	18	
Jan.	1,	17	28	—	23	21	6	12		10	47	A.M.	3	22	

NEPTUNE.

Nov.	1,	6	15	+	22	16	8	16	P.M.	3	37	A.M.	10	58	A.M.
Dec.	1,	6	13	+	22	16	6	16		1	37		8	58	
Jan.	1,	6	9	+	22	17	4	6		11	27	P.M.	6	48	

ECLIPSES OF *JUPITER'S* SATELLITES, P. S. T.

(Off right-hand limb as seen in an inverting telescope.)

II, D, Nov. 1, 7 ^h 33 ^m P.M.	II, R, Dec. 3, 7 ^h 26 ^m P.M.
I, R, 3, 7 57	I, R, 5, 4 36
IV, D, 4, 6 44	I, R, 12, 6 31
IV, R, 4, 11 28	III, D, 19, 1 41
III, R, 6, 5 5	III, R, 19, 5 13
II, R, 8, 10 12	I, R, 19, 8 26
I, R, 10, 9 53	II, R, 21, 2 2
I, R, 12, 4 21	I, R, 21, 2 55
III, D, 13, 5 34	III, D, 26, 5 42
III, R, 13, 9 6	III, R, 26, 9 14
I, R, 19, 6 17	II, R, 28, 4 41
III, D, 20, 9 35	I, R, 28, 4 50
IV, R, 21, 5 40	
II, R, 26, 4 48	
I, R, 28, 2 41	

THE SEARCH FOR AN INTRA-MERCURIAL PLANET
AT THE TOTAL SOLAR ECLIPSE
OF 1901, MAY 18.

BY C. D. PERRINE.

The considerable motion of the line of apsides of *Mercury's* orbit, found by LEVERRIER and others, cannot be explained by the attraction of the known bodies in the system, but would be fully accounted for by a planet or ring of planets between *Mercury* and the Sun.

The question is one which has attracted more or less attention from astronomers for over a century, and announcements have been made at various times of the supposed discoveries of such bodies. None of these announcements have ever been verified, however.

The solution of the problem is of peculiar difficulty. The necessary observations are possible only during the few minutes of a total eclipse, when the Sun's disk is entirely hidden. At any other time it would be impossible to detect an object very much fainter than *Mercury*.

The early searches at total eclipses were all made visually, and it was necessary to memorize the position and brightness of all the brighter stars in the region to be examined. The liability